

APPENDIX E

PRELIMINARY COST ESTIMATES

Capital Cost Estimates

King County Conveyance System Improvements Project
Equation for Annual O&M for Off-Line Storage (Draft)

Prepared by HDR

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DATE: July 28, 1999

TO: Janice Johnson

FROM: Susan Poulsom
Jim Peterson

RE: Equation for Annual O&M for Off-line Storage (Draft)

This memo presents the development of an equation to calculate annual O&M costs for off-line storage. The following general assumptions were made regarding the off-line storage facilities:

- The storage facility will include an automated washdown system.
- Gravity flow into and pump out of the storage facility.
- Dewatering pumps would discharge from the storage facility back to the interceptor.
- The pumps would be designed to dewater the facility in 12 hours.

Individual components contributing to the annual off-line storage O&M costs include:

- Maintenance materials
- Labor for scheduled inspections and maintenance
- Maintenance labor following a storm event
- Odor control (carbon and labor for carbon replacement)

Each of these components is discussed below. Energy costs per storm event were evaluated but were found to be negligible.

Cost Components

Maintenance Materials

An equation for the cost of annual maintenance materials was developed from CWC W/W Cost Program based on a raw water pumping station. It was assumed that the materials costs for a pump, which operates periodically, would be the same as those for a pump which operates on a more frequent basis. The firm capacity of the pump station was sized to drain the storage facility in 12 hours.

The resulting equation for the annual maintenance materials is:

$$\text{Annual O\&M Maintenance Materials \$} = 2,786 * \text{storage volume in MG} + 2,483$$

Labor for Scheduled Inspections and Maintenance

This includes site visits, grounds and facility cleanup, testing equipment, and lubricating equipment, etc.

Costs were based:

- 4 hours per visit
- 1 visit per month (all year round)
- 2 people per visit
- Labor rate of \$50 per hour

The resulting annual labor costs for maintenance and inspections are: \$4,800

Maintenance Labor Following a Storm Event

Following each storm event, the storage facility would be dewatered and washed down to prepare for the next event. The amount of labor for a storage facility will depend on the degree of automation of the cleanup and how well the cleanup system works. It is assumed that the storage facility would be equipped with automated washdown system. Additional labor would be required to conduct final cleanup.

The following assumptions were made:

- 2 people
- 8 hours per person per event
- Labor rate of \$50 per hour

The resulting equation for the maintenance labor following a storm event is:

$$\text{Annual O\&M Storm Event Maintenance Labor \$} = 800 * \text{number of events per year}$$

Note that the volume of the basin used during an individual storm, relative to the size of the facility, is not accounted for in the equation. In reality, it would impact the clean-up labor involved. Generally, an off-line storage facility would be divided into basins which, would fill sequentially during a storm event. Cleaning would not be necessary in those basins which remain unused during a storm event.

Odor Control

The following assumptions were made regarding odor control:

- An 8-foot diameter scrubber would be required for a 2 MG storage facility. Scrubber size and costs for larger facilities would increase proportionally
- The carbon would be replaced once every three years.
- Costs for carbon equals \$2.50 per pound (includes labor costs for replacement)
- Required carbon for 8-foot diameter scrubber is 4,820 lbs.

The resulting equation for odor control is:

$$\text{Annual O\&M Odor Control \$} = 2,000 * \text{storage volume in MG}$$

Off-line Storage Equation

Combining the individual components presented above, the resulting equation for annual O&M costs for off-line storage is:

$$\text{\$} = (4,790 * \text{storage volume in MG}) + (800 * \text{number of events per year}) + 7,300$$

Example Calculation

For a 4 MG storage facility, which is used once every five years, the estimated annual O&M, is:

$$\text{\$} = (4,790 * 4) + (800 * 0.2) + 7,300 = 26,620$$

King County CSI Project
North Creek Storage Facility - Construction Cost Estimate
Alternative A - 6 Million Gallon Basin

	Quantity	Units	Unit Cost	Total Cost
Division 2				
Excavation	110,000	CY	\$15	\$1,650,000
Backfill	33,500	CY	\$15	\$502,500
Soil Erosion and Sediment Control	1	LS	\$20,000	\$20,000
Shoring	62,000	SF	\$40	\$2,480,000
Install Dewatering System	1	LS	\$150,000	\$150,000
Dewatering	18	MN	\$25,000	\$450,000
36" RCP	520	LF	\$300	\$156,000
72" Manhole	4	EA	\$8,000	\$32,000
Division 3				
Concrete: Slabs on Grade	13,200	CY	\$300	\$3,960,000
Concrete: Walls	4,000	CY	\$550	\$2,200,000
Concrete: Suspended Slabs	6,000	CY	\$600	\$3,600,000
Division 5				
Miscellaneous Metals	1	LS	\$20,000	\$20,000
Access Hatches	8	EA	\$6,000	\$48,000
Division 6				
RTP Grating	2,600	SF	\$50	\$130,000
RTP Railings	800	LF	\$100	\$80,000
RTP Ladders	1	LS	\$15,000	\$15,000
Division 10				
Identification, Stenciling, and Tagging Systems	1	LS	\$10,000	\$10,000
Division 11				
Equipment: Submersible Pump	4	EA	\$30,000	\$120,000
Equipment: Sump Pump	2	EA	\$12,000	\$24,000
48"x 48" Sluice Gate - Handwheel Operator	3	EA	\$35,000	\$105,000
Flush Gates w/ Operators	12	EA	\$40,000	\$480,000
Division 15				
Miscellaneous Pump Piping and Valves	1	LS	\$50,000	\$50,000
Breaktank, Pumps, and Other NPW Equipment	1	LS	\$25,000	\$25,000
Washdown Piping	1	LS	\$25,000	\$25,000
Washdown Equipment: Hoses and Water Cannons	1	LS	\$20,000	\$20,000
Utilidor HVAC Equipment	1	LS	\$40,000	\$40,000
SUBTOTAL				\$16,392,500
Division 16 & 17				
Electrical, Lighting and Controls @		10%		\$1,639,000
SUBTOTAL				\$18,031,500
Contingency @		25%		\$4,508,000
SUBTOTAL				\$22,539,500
Mobilization @		5.0%		\$1,127,000
Estimated Direct Construction Cost				\$23,666,500
Sales Tax @		8.6%		\$2,035,000
Total Estimated Construction Cost				\$25,702,000

King County CSI Project
North Creek Storage Facility - Construction Cost Estimate
Alternative B - 6 Million Gallon Piped Storage

	Quantity	Units	Unit Cost	Total Cost
Division 2				
Excavation	140,000	CY	\$15	\$2,100,000
Backfill	63,600	CY	\$15	\$954,000
Soil Erosion and Sediment Control	1	LS	\$20,000	\$20,000
Shoring	75,000	SF	\$40	\$3,000,000
Install Dewatering System	1	LS	\$150,000	\$150,000
Dewatering	18	MN	\$30,000	\$540,000
10'x16' Box Culvert	5,020	LF	\$1,500	\$7,530,000
36" RCP	520	LF	\$300	\$156,000
72" Manholes	4	EA	\$8,000	\$32,000
Division 3				
Concrete: Slabs on Grade	3,000	CY	\$300	\$900,000
Concrete: Walls	3,000	CY	\$550	\$1,650,000
Concrete: Suspended Slabs	1,400	CY	\$600	\$840,000
Division 5				
Miscellaneous Metals	1	LS	\$20,000	\$20,000
Access Hatches	8	EA	\$6,000	\$48,000
Division 6				
RTP Grating	2,600	SF	\$50	\$130,000
RTP Railings	800	LF	\$100	\$80,000
RTP Ladders	30	LS	\$1,500	\$45,000
Division 10				
Identification, Stenciling, and Tagging Systems	1	LS	\$10,000	\$10,000
Division 11				
Equipment: Submersible Pump	4	EA	\$30,000	\$120,000
Equipment: Sump Pump	2	EA	\$12,000	\$24,000
48"x 48" Sluice Gate - Handwheel Operator	14	EA	\$35,000	\$490,000
Flush Gates w/ Operators	15	EA	\$40,000	\$600,000
Division 15				
Miscellaneous Pump Piping and Valves	1	LS	\$50,000	\$50,000
Breaktank, Pumps, and Other NPW Equipment	1	LS	\$25,000	\$25,000
Washdown Piping	1	LS	\$25,000	\$25,000
Washdown Equipment: Hoses and Water Cannons	1	LS	\$20,000	\$20,000
Utilidor HVAC Equipment	1	LS	\$40,000	\$40,000
SUBTOTAL				\$19,599,000
Division 16 & 17				
Electrical, Lighting and Controls @		10%		\$1,960,000
SUBTOTAL				\$21,559,000
Contingency @		25%		\$5,390,000
SUBTOTAL				\$26,949,000
Mobilization @		5.0%		\$1,347,000
Estimated Direct Construction Cost				\$28,296,000
Sales Tax @		8.6%		\$2,433,000
Total Estimated Construction Cost				\$30,729,000

King County CSI Project
North Creek Storage Facility - Construction Cost Estimate
Alternative A - 14 Million Gallon Basin

	Quantity	Units	Unit Cost	Total Cost
Division 2				
Excavation	191,000	CY	\$15	\$2,865,000
Backfill	48,000	CY	\$15	\$720,000
Soil Erosion and Sediment Control	1	LS	\$20,000	\$20,000
Shoring	106,000	SF	\$40	\$4,240,000
Install Dewatering System	1	LS	\$150,000	\$150,000
Dewatering	24	MN	\$30,000	\$720,000
Auger Cast Piles	800	EA	\$4,000	\$3,200,000
36" RCP	520	LF	\$300	\$156,000
72" Manholes	4	EA	\$8,000	\$32,000
Division 3				
Concrete: Slabs on Grade	11,500	CY	\$300	\$3,450,000
Concrete: Walls	12,000	CY	\$550	\$6,600,000
Concrete: Suspended Slabs	6,500	CY	\$600	\$3,900,000
Division 5				
Miscellaneous Metals	1	LS	\$20,000	\$20,000
Access Hatches	8	EA	\$6,000	\$48,000
Division 6				
RTP Grating	5,200	SF	\$50	\$260,000
RTP Railings	1,600	LF	\$100	\$160,000
RTP Ladders	1	LS	\$20,000	\$20,000
Division 10				
Identification, Stenciling, and Tagging Systems	1	LS	\$10,000	\$10,000
Division 11				
Equipment: Submersible Pump	4	EA	\$50,000	\$200,000
Equipment: Sump Pump	2	EA	\$15,000	\$30,000
48"x 48" Sluice Gate - Handwheel Operator	3	EA	\$40,000	\$120,000
Flush Gates w/ Operators	12	EA	\$40,000	\$480,000
Division 15				
Miscellaneous Pump Piping and Valves	1	LS	\$70,000	\$70,000
Breaktank, Pumps, and Other NPW Equipment	1	LS	\$25,000	\$25,000
Washdown Piping	1	LS	\$25,000	\$25,000
Washdown Equipment: Hoses and Water Cannons	1	LS	\$20,000	\$20,000
Utilidor HVAC Equipment	1	LS	\$50,000	\$50,000
SUBTOTAL				\$27,591,000
Division 16 & 17				
Electrical, Lighting and Controls @		10%		\$2,759,000
SUBTOTAL				\$30,350,000
Contingency @		25%		\$7,588,000
SUBTOTAL				\$37,938,000
Mobilization @		5.0%		\$1,897,000
Estimated Direct Construction Cost				\$39,835,000
Sales Tax @		8.6%		\$3,426,000
Total Estimated Construction Cost				\$43,261,000